

PART 1 – GENERAL

1.1 DESCRIPTION

This work consists of constructing permanent, post-tensioned, multi-strand ground anchors having Class I Corrosion Protection in accordance with the current PTI *Guide Specification for Post-Tensioning Materials* as shown on the Plan and described herein.

1.2 MATERIAL

Materials required include ground anchors and grout per Subsections 1.2.1 and 1.2.2 all related materials as described herein or required in the current PTI *Guide Specification for Post-Tensioning Materials*:

1.2.1 Grout

A. Description. Provide neat cement or sand/cement grout for micropiles and permanent ground anchors in accordance with the following:

1. Provide grout mix design conducted by a certified, independent testing laboratory for submission to EPM for review and approval prior to grout placement.
2. Provide a pumpable mix using Type V cement that is stable (bleed less than 2 percent) and has a water:cement ratio less than 0.45 that will attain a minimum 3-day compressive strength of 2000 psi and a 28-day compressive strength of at least 4000 psi per AASHTO T106 or ASTM C109.
3. Use water in the grout mix conforming to AASHTO T26 that is potable, clean, and free of substances that may be deleterious to cement and steel.
4. Use sand conforming to AASHTO M45 or ASTM C144 if a sand-cement grout is to be used.

B. Measurement. Grout will not be measured separately and will be considered incidental to other items.

C. Payment. Payment is considered incidental to other items.

1.2.2 Ground Anchor Materials

A. Tendons. Provide 7-wire strand elements with minimum wire diameter and ultimate tensile stress of 0.6-inch and 270 ksi, respectively, meeting ASTM A-416 and manufactured in accordance with the current PTI *Guide Specification for Post-Tensioning Materials* recommendations for double corrosion protected anchors.

- B. Sheathing. Conform to one of the following:
1. Unbonded Length.
 - a. High-density polyethylene tube. Conform to ASTM D 1248, type II, III, or IV with a minimum wall thickness of 60 mils.
 - b. Hot-melt extruded polypropylene tube. Conform to ASTM D 4101, cell classification PP 210 B5554211 with a minimum wall thickness of 60 mils.
 - c. Hot-melt extruded polyethylene tube. Conform to ASTM D 3350 and D 1248 high-density type II with a minimum wall thickness of 60 mils.
 - d. Plastic pipe. Conform to ASTM D 1785, Schedule 40 minimum.
 2. Bonded Length.
 - a. High-density corrugated polyethylene tubing. Conform to AASHTO M 252 with a minimum wall thickness of 30 mils.
- C. Grease. Corrosion inhibiting grease conforming in accordance with current PTI *Guide Specification for Post-Tensioning Materials*.

1.3 CONSTRUCTION REQUIREMENTS

1.3.1 Qualifications

The Contractor or subcontractor performing the ground anchor work shall have completed at least 5 permanent ground anchor projects within the last 3 years. Submit a brief description of each project including the owning agency's name and current telephone number.

Provide a professional engineer with at least 3 years experience in the design and construction of permanent ground anchors. Provide on-site supervisors and drill operators with at least 1 year experience installing permanent ground anchors. At least 30 days before starting ground anchor work, identify the professional engineer, on-site supervisors, and drill operators assigned to the project and submit a summary of each individual's experience.

1.3.2 Design/Drawings

Select the ground anchor type and installation method, and determine the anchor bond length and diameter consistent with the stabilization requirements shown on the Plan. Install ground anchors that will develop the load indicated in the Plans and verified by load tests specified in Section 1.3.6. At least 30 days before starting ground anchor work, submit drawings according to Subsection 104.03. Include the following:

- A. A ground anchor schedule giving the following information:
 - 1. Ground anchor number;
 - 2. Ground anchor design load;
 - 3. Type and size of tendon;
 - 4. Minimum total anchor length;
 - 5. Minimum bond length;
 - 6. Minimum tendon bond length; and
 - 7. Minimum unbonded length.
- B. Include the following details in the ground anchor system drawings:
 - 1. Spacers and their location;
 - 2. Centralizers and their location;
 - 3. Unbonded length corrosion protection system;
 - 4. Bond length corrosion protection system;
 - 5. Transition between the unbonded length and the bond length corrosion protection systems;
 - 6. Anchorage and trumpet; and
 - 7. Anchorage corrosion protection system.

1.3.3 Tendon Fabrication

- A. Fabricate the tendons in either the shop or field as indicated on the Drawings. Size the tendons so:
 - 1. The design load does not exceed 60 percent of the minimum required ultimate tensile strength of the anchor; and
 - 2. The maximum test load does not exceed 80 percent of the minimum specified ultimate tensile strength of the anchor.
- B. Bond length. Determine the bond length necessary to develop the design load indicated on the drawings. Use a minimum tendon bond length of 40 feet into shale. Provide corrosion protection of the entire bond length as described herein.

Protect the tendon length from corrosion by encapsulating it in a grout-filled corrugated plastic tube or by coating it with fusion-bonded epoxy. Place the grout inside the tube either before or after the tendon is placed in the drill hole. Centralize the tendon within the tube with a minimum 1/8-inch grout cover.

C. Centralizers. Use spacers along the tendon bond length of a multi-element tendon to separate each of the individual elements/strands. Use centralizers to ensure a minimum of 1/2 inch of grout cover over the bond length encapsulation. Use centralizers that do not impede the free flow of grout up the bore hole. Position centralizers so their center-to-center spacing does not exceed 10 feet.

Locate the upper centralizer a maximum of 5 feet from the top of the tendon bond length. Locate the lower centralizer a maximum of 12 inches from the bottom of the tendon bond length.

D. Unbonded length. Provide minimum unbonded length of 15 feet.

1. If the entire drill hole is grouted in one operation, provide corrosion protection of the unbonded length with a sheath completely filled with corrosion-inhibiting grease or grout, or a heat-shrinkable tube internally coated with an elastic adhesive.

If grease is used under the sheath, completely coat the unbonded tendon length, fill spaces between individual elements of multi-element tendon with grease, and provide measures to prevent grease from escaping at the ends of the sheath.

If the sheath is grout filled, provide a separate bondbreaker along the unbonded length of the tendon.

2. If a grease-filled sheath corrosion protection is provided and the drill hole above the bond length is grouted after the ground anchor is locked off, grout the tendon inside a second sheath.

Properly seat the wedges as recommended for the post-tensioning system provided.

E. Bearing plates. Size the bearing plates so:

1. The bending stresses in the plate do not exceed the yield strength of the steel when a load equal to 95 percent of the minimum specified ultimate tensile strength of the tendon is applied; and

2. The average bearing stress of the bearing plate does not exceed that recommended in section 3.1.7 of the PTI, *Guide Specification for Post-Tensioning Materials*.

Weld trumpet to bearing plate. Make the inside diameter of the trumpet equal to or larger than the hole in the bearing plate. Make the trumpet long enough to accommodate movements during stressing and testing. For multi-element tendons with encapsulation over the unbonded length, make the trumpet long enough to enable

the tendon to make a transition from the diameter of the tendon in the unbonded length to the diameter of the tendon at the anchorhead without damaging the encapsulation. Fill the trumpet of restressable ground anchors with corrosion-inhibiting grease. Provide a permanent Buna-N synthetic rubber seal or an approved equal between the trumpet and the unbonded length corrosion protection.

Fill the trumpets of non-restressable ground anchors with grout. Provide a 12-inch minimum tightly-fitting temporary seal between the trumpet and the unbonded length corrosion protection.

1.3.4 Storing and Handling

Handle and store tendons in a manner to avoid damage or corrosion. Replace tendons exhibiting abrasions, cuts, welds, weld splatter, corrosion or pitting. Repair or replace any tendons exhibiting damage to encapsulation or sheathing. Degrease the bond length of tendons, and remove solvent residue before installation.

1.3.5 Installation

Select the drilling method, the grouting procedure, and the grouting pressures used for the installation of ground anchors consistent with the Plan, Specifications, and the design intent. Discontinue drilling when caving conditions are encountered and select a method to prevent further ground movement approved by the PM.

Drill ground anchor holes within 12 inches of the required location. Drill the longitudinal axis of the drill hole parallel to the longitudinal axis of the tendon. Install the ground anchor within 2 degrees of the required inclination from horizontal. Install the ground anchor with a horizontal angle within 2 degrees of a line drawn perpendicular to the plane of the structure. Do not extend ground anchors beyond the right-of-way or easement limits.

Insert the tendon in the drill hole to the required depth without driving or forcing. Where the tendon cannot be completely inserted, remove the tendon, and clean or redrill the hole to permit insertion.

Use a positive displacement pump to grout tendons into drill holes using either a neat cement grout or a sand/cement grout. Use a grout pump equipped with a pressure gauge capable of measuring pressures of at least 150 pounds per square inch or twice the actual grout pressure, whichever is greater. Use well-mixed grout that is free of lumps or other indications of prior cement hydration. Continuously agitate the grout during placement. Place the grout in one continuous operation.

Inject the grout from the lowest point of the drill hole. The grout may be placed either before or after insertion of the tendon. Record the quantity of the grout and the grout pressure for each ground anchor. Control the grout pressures, procedures, and mix to avoid excessive heaving, fracturing, or take volume.

Except as indicated below, the grout above the top of the bond length may be placed at the same time as the bond length grout, but it shall not be placed under pressure. Do not place grout at the top of the drill hole in contact with the back of the structure or the bottom of the trumpet.

If the ground anchor is installed in a fine-grained soil using drill holes larger than 6 inches in diameter, place the grout above the top of the bond length after the ground anchor has been tested and stressed. The entire drill hole may be grouted at one time if it can be demonstrated that the ground anchor does not derive a significant portion of its load-carrying capacity from the soil above the bond length.

Use pressure grouting for grout protected tendons anchored in rock. After sealing the drill hole, pressure inject grout until a 50-pound per square inch grout pressure at the top of the drill hole is maintained for 5 minutes.

After grouting is complete, fill the grout tube with grout if it will remain in the hole. Wait a minimum of 3 days before loading the tendon or until the grout has attained a compressive strength of 2000 psi.

Extend the corrosion protection surrounding the unbonded length up beyond the bottom seal of the trumpet or 12 inches into the trumpet if no trumpet seal is provided.

Trim the corrosion protection surrounding the unbonded length of the tendon as necessary so that it does not contact the bearing plate of the anchorhead during testing and stressing.

Place the bearing plate and anchorhead so the axis of the tendon is within 3 degrees of perpendicular to the bearing plate and the axis of the tendon passes through the center of the bearing plate without bending the tendon.

Place trumpet grease any time during construction. Place trumpet grout after the ground anchor has been tested and stressed.

Completely isolate all anchorages from backfill and atmosphere with a corrosion resistant, water tight, grout-filled cover.

1.3.6 Testing and Stressing

Test each ground anchor using a maximum test load not to exceed 80 percent of the minimum ultimate tensile strength of the tendon.

Simultaneously apply the test load to the entire tendon and all elements of multi-element tendons.

- A. Testing equipment. The testing equipment shall consist of:
1. A dial gauge or vernier scale capable of measuring to 0.001 inch. Use a movement-measuring device having a minimum travel equal to the theoretical elastic elongation of the total anchor length at the maximum test load. Use a device with sufficient travel so the anchor movement is measured without resetting the device.
 2. A hydraulic jack and pump. Use a jack and a calibrated pressure gauge to measure the applied load. Have the jack and pressure gauge calibrated as a unit by an independent firm within 45 days of the start of ground anchor work. Use a pressure gauge graduated in 100-pound per square inch increments or less. Use a jack having a minimum ram travel equal to the theoretical elastic elongation of the total anchor length at the maximum test load.

3. A calibrated reference gauge. Have the reference gauge calibrated with the test jack and pressure gauge. Keep it at the project site.

B. Performance tests. Place stressing equipment over the ground anchor tendon so that the jack, bearing plates, load cells, and stressing anchorage are axially aligned with the tendon and the tendon is centered within the equipment.

Performance test 5 percent of the ground anchors or a minimum of 3 anchors, whichever is greater, at each separate structure. The PM will select the ground anchors to be performance tested.

Perform the performance test as indicated in Table 256-1.

Raise the load from one increment to another immediately after recording the ground anchor movement. Measure and record the ground anchor movement to the nearest 0.001 inch with respect to an independent fixed reference point at the alignment load and at each load increment. Monitor the load with a pressure gauge. Place the reference pressure gauge in series with the pressure gauge during each performance test. If the load measured by the pressure gauge and the load measured by the reference pressure gauge differ by more than 10 percent, recalibrate the jack, pressure gauge, and reference pressure gauge. At load increments other than the maximum test load, hold the load just long enough to obtain the movement reading.

Table 256-1
Performance Test Load Sequence

Test Sequence	Test Load Increment							Reduce to Lock-Off Load
	A	0.25D	0.50D	0.75D	1.00D	1.20D	1.33D	
1	•	•						
2	•	•	•					
3	•	•	•	•				
4	•	•	•	•	•			
5	•	•	•	•	•	•		
6	•	•	•	•	•	•	•	•

Note: A = Alignment load; D = Design load.

Hold the maximum test load for a minimum of 10 minutes. Repump the jack as necessary in order to maintain a constant load. Begin the load-hold period as soon as the maximum test load is applied.

DIVISION 1 – GENERAL REQUIREMENTS

**SECTION 00256
PERMANENT GROUND ANCHORS**

Measure and record the ground anchor movement at 1, 2, 3, 4, 5, 6, and 10 minutes. If the ground anchor movement between 1 and 10 minutes exceeds 0.04 inches, continue holding the maximum test load and record ground anchor movement at 15, 20, 25, 30, 45, and 60 minutes.

Plot the ground anchor movement versus the maximum load for each test sequence in Table 256-1, and plot the residual movement of the tendon at each alignment load versus the highest previously applied load.

C. Proof tests. Proof test all ground anchors that are not performance tested. Perform the proof test as indicated in Table 256-2.

Raise the load from one increment to another immediately after recording the ground anchor movement. Measure and record the ground anchor movement to the nearest 0.001 inch with respect to an independent fixed reference point at the alignment load, and at each load increment. Monitor the load with a pressure gauge.

Hold the maximum test load for a minimum of 10 minutes. Repump the jack as necessary in order to maintain a constant load. Begin the load-hold period as soon as the maximum test load is applied.

Measure and record the ground anchor movement at 1, 2, 3, 4, 5, 6, and 10 minutes. If the anchor movement between 1 and 10 minutes exceeds 0.04 inches, continue holding the maximum test load and record anchor movements at 15, 20, 25, 30, 45, and 60 minutes.

Table 256-2
Proof Test Load Sequence

Test Load Increment							
A	0.25D	0.50D	0.75 D	1.00D	1.20 D	1.33D	Reduce to Lock-Off Load
•	•	•	•	•	•	•	•

Note: A = Alignment load; D = Design load.

Plot the ground anchor movement versus load for each load increment in Table 256-2.

D. Lock off. Upon completion of performance and proof tests, reduce the load to the specified lock-off load and transfer the load to the anchorage device. After transferring the load and before removing the jack, measure the lift-off load. If the load is not within 10 percent of the specified lock-off load, reset the anchorage and remeasure the lift-off load. Repeat as necessary.

1.3.7 Acceptance.

See Table 256-3 for sampling and testing requirements.

Material for ground anchors will be evaluated under Subsections 106.02 and 106.03.

Construction of ground anchors and services will be evaluated under Subsections 106.02 and 106.04.

Grouting will be evaluated under Subsection 106.02 and 106.04.

Installed ground anchors will be evaluated based on one of the following performance or proof test results:

A. After a 10-minute hold, the ground anchor carries the maximum test load with less than 0.04 inches of movement between 1 and 10 minutes and the total movement at the maximum test load exceeds 80 percent of the theoretical elastic elongation of the unbonded length.

B. After a 60-minute hold, the ground anchor carries the maximum test load with a creep rate that does not exceed 0.08 inches per log cycle of time and the total movement at the maximum test load exceeds 80 percent of the theoretical elastic elongation of the unbonded length.

Replace all ground anchors with unacceptable performance or proof test results. Do not retest failed ground anchors.

PART 2 – PRODUCTS NOT USED

PART 3 – EXECUTION NOT USED

PART 1 – GENERAL**1.1 DESCRIPTION**

This work consists of constructing horizontal drains including collector systems as required per Project Plan. The collector systems include headworks and piping as necessary to convey slope water to designated discharge point(s) as shown on the Plan and approved by the Project Manager (PM). This work also includes construction and reclamation of all necessary temporary work such as access trails, drill pads, sedimentation control for drill fluids and drill cuttings, and control of erosional disturbance consistent with Project requirements and permits.

1.2 MATERIAL

Horizontal drains shall consist of nominal 1.5 inch diameter Schedule 80 PVC pipe conforming to the requirements of ASTM 01785. Drain pipe shall be machine slotted with two rows of slots circumferentially on the third points that are 120° apart. Slot width shall be 0.010 inch and frequency of the slots shall provide a minimum opening area of 0.46 square inches per lineal foot of pipe. Provide drain pipe with factory threaded ends for pipe connection or couplers per item (a)(1) below.

1.2.1 Appurtenant Materials

- A. Furnish Schedule 80 PVC couplers for the horizontal drain pipe and connect drain pipe sections with solvent weld.
- B. Provide unslotted Schedule 80 PVC pipe sections 10 feet in length for the outlet of each drain.
- C. Provide galvanized steel end casing/collar with a nominal length of 5 feet that can be positively connected to the unslotted pipe for outlet protection. The casing shall be threaded or otherwise adapted to provide appropriate connection to discharge piping and shall have an insulated, removable end cap for cleaning.
- D. Provide Portland cement grout for packing the unslotted drain length of each pipe; grout shall be batched using Type I-II or Type V cement to attain a 28-day compressive strength of 1000 psi.
- E. Provide discharge hardware (corrosion protected) for connection of drains to the discharge conduit system shown on the Plan.

1.3 QUALIFICATIONS

30 days prior to commencement of drilling, the Contractor shall submit to the PM for review and approval a statement of qualifications that describes similar project experience and the key personnel to be assigned to this project. The submittal shall as a minimum contain the following information:

- Resumes of the project manager and drilling superintendent/lead driller.
- Evidence of the successful and safe completion of horizontal drain installation by these personnel on at least 5 projects of similar scale and complexity over the prior 3 year period.

1.4 METHODS STATEMENT

15 days prior to commencement of drilling, the Contractor shall submit a method and materials statement to the PM for review and approval. This statement shall describe means, methods, and specific equipment that are proposed for drilling, flushing, pipe slope/orientation verification, drain installation, outlet annulus sealing, and completion of outlet works and related piping. The statement shall include a description of the proposed outlet connection to the discharge conduit system shown on the Plan; the outlet connection is to be a Contractor design approved by the PM.

1.5 DRILLING EQUIPMENT

Use rotary equipment capable of drilling holes up to at least 4 inches in diameter or as necessary to install drains through mandatory casing for hole stabilization. The drill shall be capable of advancing holes to lengths and at inclinations shown on the Plan consistent with the subsurface information provided in the Geotechnical Investigation Report and as discussed in the attached Geotechnical Advisory Specification.

1.6 HORIZONTAL DRAIN INSTALLATION

The locations for horizontal drain installation as shown on the Plan are approximate, and exact locations and drilling sequence should be determined in the field per the approval of the PM. The Contractor shall construct access roads and drill pads as necessary within limits and routes that have been delineated and approved by the PM.

The drill holes shall be cased and advanced using clean water as a drilling fluid unless other drilling media are approved by the PM. Recirculate drill water as possible; route disposal water to sediment detention containers to prevent erosion and site contamination. Sediment shall be disposed off-site at a location approved by the PM.

The holes shall be drilled within 2° of the Plan or approved inclination and orientation. The Contractor shall verify the inclination/orientation of each hole at minimum intervals not to exceed 100 feet.

Upon hole completion, plug the entrance end of the drain pipe with a solidly fixed cap and insert the drain pipe inside the casing with slots upward; the exterior 10 feet of the drain pipe shall be unslotted as shown on the Plan. Retract the casing following insertion of the drain pipe to Plan length. Following casing removal, perform water

flushing of the drains to their full length as necessary and as required by the PM to ascertain that the pipe is flowing properly and free of undue sediment.

Conduct grouting of the unslotted annulus and install the protective collar. Install headworks and provide hardware for connection of drains to the discharge system shown on the Plan. Provide permanent identification marking of each drain attached to the unslotted pipe or collar per PM approval. Provide as-built records and drawings of the drains for submission to the PM; submittal is to be approved by the PM for the Project record.

PART 1 – GENERAL**1.1 DESCRIPTION**

These Special Provisions supersede the Montana Public Works Standard Specifications governing this project. All provisions which are not amended shall remain in full force and effect.

Any subsequent addenda issued after these specifications have been prepared shall supplement and/or supersede any article of these specifications.

1.2 ORDER OF PRECEDENCE

In case of a conflict, precedence shall be given the order of:

- 1) Any fully executed Field Order or Change Order issued after the bidding period.
- 2) Any addenda issued during the bid advertisement period.
- 3) Special Provisions (Section 00910).
- 4) Modifications to the Montana Public Works Standard Specifications included herein.
- 5) MPWSS Sixth Edition, April 2010 (By Reference).

1.3 PRELIMINARY MATTERS**1.3.1 Survey Markers and Monuments**

The CONTRACTOR shall protect and not disturb any survey markers or monuments, such as section corners or section breakdown corners. Any survey marker or monument that is disturbed or destroyed by the CONTRACTOR shall be replaced at no cost to the OWNER by a State of Montana licensed land surveyor at the CONTRACTOR'S expense.

1.4 PROJECT COORDINATION**1.4.1 Use of Premises**

- A. The CONTRACTOR shall confine his operations to existing right-of-way at the site of the proposed work. Materials and equipment may be at two of the three locations identified by the OWNER. An aerial photo showing the locations of the three proposed staging areas is included at the end of this Specification. It shall be understood that the responsibility for protection and safekeeping of equipment and materials on or near the site will be entirely that of the CONTRACTOR and that no claim shall be made against the OWNER by reason of any act of an employee or trespasser.

1.4.2 Cleaning

The CONTRACTOR shall not clean any equipment on the project using diesel fuel as a solvent.

1.4.3 Access

The CONTRACTOR shall have the road open for access from 5:30pm to 7:00am Monday night through Friday morning and from 3:00pm to 7:00am Friday night through Monday morning.

The CONTRACTOR shall have the road open from 5:30pm on Thursday, September, 18, 2014 through 7:00am Monday, September 22, 2014 for an event being held at the Lion's Camp.

In the event of a medical or other emergency situation, the CONTRACTOR shall make one lane passable upon request.

1.4.4 Construction Water

Construction water is available from the fire hydrant located near the Visitor's Center at no cost to the CONTRACTOR. The CONTRACTOR shall coordinate with the City of Glendive Public Works Department for operation of the hydrant.

1.5 EXISTING FACILITIES

1.5.1 Pavement Damage

The CONTRACTOR is responsible for the protection of and the cost to replace any and all asphalt damaged, including damage caused by trench sloughing. The CONTRACTOR shall use equipment sized and equipped to protect the asphalt or pay for replacing the asphalt at his cost. The CONTRACTOR shall make his own assessment of the situation and adjust his bid accordingly.

The CONTRACTOR shall video or otherwise document the pre-construction condition of the entry road from the Park entrance to the project site.

1.5.2 Pavement / Lane Markings

All pavement/lane markings damaged or removed as part of the work shall be restored to a condition equal or better than the pre-existing condition. The CONTRACTOR shall be responsible for centerline striping that is disturbed in the work area.

This striping is located on the plans for reference only. CONTRACTOR, along with an RPR, shall properly document the pre-construction location, color, condition, and material of all markings prior to construction. CONTRACTOR shall submit the

striping inventory to ENGINEER for review and approval prior to construction.

For repainting, the work area shall include not only the pavement markings disturbed by the trench restoration, but also any area where pavement markings have been dulled, covered, scratched, marred, or otherwise disturbed by the CONTRACTOR'S operations. "CONTRACTOR'S operations" include all construction operations and pavement restoration, traffic control, or storage of equipment or materials necessary for this project.

Surface preparation and marking shall be as specified in Section 02581 and 02582 of the Montana Public Works Specifications, Sixth Edition. The width and layout of stripes on the area to be painted shall match the markings disturbed and shall be laid out by the CONTRACTOR and approved by the ENGINEER prior to applying the marking or tape.

1.6 ENVIRONMENTAL CONTROLS

The following items are included in the General Requirements bid item. No additional payment will be made for performance of these tasks.

- 1.6.1 Keep project neat, orderly, and in a safe condition at all times. Provide on-site containers for collection of rubbish and dispose of it at frequent intervals during the progress of work. No burning of debris will be permitted inside the City limits. No trash shall be disposed of in the trench or excavations.
- 1.6.2 The CONTRACTOR shall sweep paved areas and water unpaved dry areas as deemed necessary by the ENGINEER to control soil dust, specifically on detour routes.
- 1.6.3 CONTRACTOR shall protect inlets, culverts, and drainage swales as required to control soil erosion until vegetation is restored.
- 1.6.4 CONTRACTOR shall dispose of all oil and petroleum products in an appropriate manner off-site. This requirement shall include any and all materials used for cleanup of such materials.
- 1.6.5 If in the opinion of the ENGINEER or OWNER the CONTRACTOR does not comply with the above referenced Environmental Controls within 24 hours of notification, the work shall be considered defective and the OWNER shall have any and all remedies available under General Conditions Article 13 (after the proper notification provisions) to correct the defective work.

1.7 SCHEDULE OF WORK

1.7.1 General

The contract time provided for the Construction Completion of this project has been figured on a Calendar Day basis allowing the CONTRACTOR to work 5 days a week, 10 hours a day. Should the CONTRACTOR decide to work more than the 5 days per week and more than 10 hours per day, or on off days (weekends or Holidays) a change in work hours shall be requested by the CONTRACTOR in writing and must be approved by the OWNER prior to change.

1.7.2 Coordination with Subcontractors

All work shift times of the Prime CONTRACTOR and his subcontractors shall coincide with each other to prevent extending the total hours of work in a single day.

1.7.3 Hours

To minimize construction noise impacts on the park visitors, no construction activities will be allowed between the hours of 5:30 p.m. and 7:00 a.m., unless explicitly allowed by the ENGINEER in writing.

1.8 SUBSURFACE CONDITIONS

1.8.1 Geotechnical Report

The CONTRACTOR shall make themselves fully aware of the ground water and subsurface conditions at the site of the work. Supplementary subsurface information is available in the report entitled "Final Geotechnical Engineering Report, Makoshika State Park Road Stabilization, Dawson County, Montana" dated January 31, 2014. This report is part of the project documents.

The CONTRACTOR shall be aware that soil moisture contents and ground water levels will fluctuate due to seasonal changes, weather, irrigation, and other variations in conditions. The BIDDERS shall make independent investigations as they believe are necessary to prepare their bid. The CONTRACTOR is responsible to determine construction methods and include these costs in the bid unit prices. Methods and procedures related to wet soils could include adjusting the moisture of the material or removal of the wet material and replacement with another suitable material.

1.8.2 Groundwater

The CONTRACTOR is advised that groundwater may be present at the project site. The CONTRACTOR is responsible for providing dewatering equipment and methods for this project. Groundwater shall be removed from the open trench area to satisfactorily prevent the rising of water into the new or any existing piping that may be exposed during the work. The CONTRACTOR shall be responsible for arrangements of permits and obtaining of sites for groundwater discharge or

flushing discharge. This shall include all cleanup, restoration, etc., of any discharge areas.

The CONTRACTOR shall consult a licensed professional engineer familiar with the local geologic, hydrogeologic, and geotechnical conditions as well as the construction practices pertaining to the CONTRACTOR's means and methods of dewatering. The CONTRACTOR shall then submit a dewatering plan stamped by a professional engineer registered in Montana that shows the methods, influences, and effects of the CONTRACTORs proposed dewatering plan. The same professional engineer shall provide written approval, bearing their seal and signature of ANY changes to this plan. This shall be submitted in accordance with Section 01300 of the specifications. The ENGINEER will review this submittal ONLY to determine that it bears the signature and seal of a professional engineer registered to practice in Montana.

The CONTRACTOR is responsible for obtaining and maintaining a dewatering permit for this project.

1.9 CUTTING, PATCHING AND RESTORATION

1.9.1 Landscape Restoration & Revegetation

- A. CONTRACTOR shall be responsible for the restoration of any and all landscape features disturbed by construction activities to a condition equal to or better than the conditions existing prior to construction as judged by the ENGINEER. Revegetation of the disturbed areas shall be achieved by seeding the areas with the approved seed mix listed below. The CONTRACTOR shall be required to stockpile all topsoil disturbed by construction at a pre-determined location, or removed from the Park, as selected by the OWNER. The CONTRACTOR may be required to import additional topsoil for placement over the Geosynthetic Clay Liner areas. Payment for landscape restoration shall be incidental to the work associated unless as specified in the Measurement and Payment Section.

Dry Site Reclamation Seed Mix:

<u>Grass Species</u>	<u>% PLS Count</u>	<u>lbs./acre</u>
Streambank Wheatgrass	40%	Drilled Rate
Western Wheatgrass	20%	(8 lbs./acre)
Sheep Fescue	15% - 20%	
Blue Grama	15% - 20%	

- B. Use topsoil that is loose, friable, loamy soil, free of excess acid and alkali. Assure topsoil does not contain any deleterious material such as sod, rocks, hard lumps, sub-soil or any other undesirable material that would form a poor seedbed. The top soil shall have a pH between 5.5 and 8.0 and soil conductivity factor of less than 4. Provide a 4" loose thickness of topsoil for the 3:1 area, from approximately STA. 16+00 to 18+00 on the right side of

the road as shown on the plans and at the reclamation sites that were used for staging. All other areas will require 2" of un-compacted topsoil. Complete topsoil areas to the lines, grades and elevations as specified. Do not place top soil until the designated areas are prepared and all construction work in the area is completed.

- C. The seeding season is October 15 through May 1. No seeding outside of these dates will be allowed.
- D. Condition the seedbed surface area by killing growing weeds, removing or mowing old weedy growth, and scarifying any compacted areas. Break up tight or compacted soils into 2" or smaller pieces.
- E. Drill seeding will be required, using equipment that regulates the seed application rate and planting depth. Maintain uniform seed distribution in the drill hopper during work. Operate all seeding related equipment at right angles to the slope.
- F. Use commercially manufactured fertilizer meeting the Contract requirements. The fertilizer must be labeled with the manufacturer's guaranteed analysis, meeting Montana fertilizer laws.
- G. Seeding areas shall be covered by and secured over top of the top soil areas with North American Green, Erosion control blanket, S150. The erosion control blanket will be secured as directed by the manufacturer. Some areas may require additional stapling to account for the high winds in the area.

1.9.2 Salvage

All pipe and manholes removed in this project shall become the property of the CONTRACTOR unless otherwise specified on the drawings. The CONTRACTOR shall be responsible for the disposal of all abandoned materials that are removed.

1.10 STORM SEWER

1.10.1 HDPE Pipe

Fusible HDPE Pipe shall contain a minimum of 2% carbon black for UV resistance on exposed Flared End Treatment Sections (FETS).

1.11 GEOSYNTHETICS

1.11.1 Geosynthetic Clay Liner

Where shown on the plans, geosynthetic clay liners shall be used. Liners shall be needlepunch-reinforced, with a minimum peel strength of 3.5 lb/inch. The moisture content of the bentonite in the finished GCL shall be between 20 and 40 percent, to ensure uniform bentonite distribution, consistent needlepunch density, and adequate electrical conductivity to maximize leak location survey sensitivity. The GCL shall have 10,000-hour test data for large-scale constant-load (creep) shear testing under hydrated conditions. The displacement shall be 0.11 in. (2.7 mm) or less at a constant shear load of 250 psf (12 kPa) and a normal load of 500 psf (24 kPa). Product shall be Bentomat ST by CETCO or approved equal.

1.12 ROCK EXCAVATION

Geotechnical bore logs indicate that shale will be present during excavation. No additional payment will be made for excavation in rock.

1.13 EARTHWORK

This item covers earthwork associated with excavation, disposal, placement, and compaction of all fill and backfill materials as shown on the Plan or otherwise required by the Specifications for construction of slope stabilization, surface and subsurface drainage, pavement subgrade, embankment, and reclamation elements of the project.

1.13.1 Classification

- A. Unclassified Excavation. Unclassified Excavation shall consist of excavated site materials to be reused for purposes in accordance with the Plan and Specifications. Material to be used for fill or backfill shall be free of topsoil, sod, other organic matter, debris, frost, and be acceptable to the Project Manager. Excess and unsuitable material shall be disposed of per the Plan and Specifications and per the approval of the Project Manager.
- B. Unsuitable Excavation. Unsuitable Excavation shall consist of site materials not acceptable for use as salvaged topsoil as defined in Section 1.9.1.B or for reuse as approved project fill or backfill per Item A. above.

1.13.2 Construction Methods

- A. Prior to beginning excavation, grading, and embankment operations in any area, the ground surface shall be completely cleared and grubbed. Salvage topsoil shall be stockpiled for subsequent use, and unsuitable materials removed and disposed of in areas approved by the Project Manager.

- B. Prior to the placement of fill for embankment, the exposed subgrade shall be compacted in accordance with Item c. below. This requirement is applicable for fill placed for reclamation and finished grading of access trails and roads in anchor and horizontal drain locations, for roadway fill and subgrade areas, and other engineered project features as designated by the Project Manager.
- C. Compaction of fill and backfill shall be in accordance with the applicable portions of Section 02230 Street Excavation, Backfill, and Compaction in the Montana Public Works Standard Specifications, 6th Edition, April 2010.

1.13.3 Acceptance

- A. Acceptance shall be based on quality control testing provided by the Owner and observations conducted by the Project Manager.

1.14 ASPHALT CONCRETE PAVING

Strike off the edges of the asphalt sides to match the slopes of the underlying aggregate.

1.14.1 Compaction and Density

The thickness of the asphalt mat shall be 3 inches **after** compaction. The density shall be equal to or greater than 95 percent of the maximum density as determined by ASTM D2041.

Compaction of asphalt shall occur at an asphalt temperature of not less than 175°F.

1.15 SEQUENCE OF WORK

Sequence of Major Activities: In order to meet the overall objectives of the project, certain elements of work will be completed by Military construction units. These elements, further defined below, shall be completed prior the CONTRACTOR mobilizing onto the project site.

1.15.1 Military Responsibilities

Military construction units will be on-site from July 15, 2014 through August 23, 2014 and shall be responsible for the following work:

- A. Installation of erosion control straw waddles (Owner till purchase and Military will install). The CONTRACTOR will carry the SWPPP.
- B. The removal and disposal of all asphalt and underlying gravel from the road for the entire project.

- C. Scarifying and compacting the native ground and installation of the first 4" lift of crushed road base material. Compaction testing for the native ground and first 4" lift will be done by local Montana Department of Transportation personnel.
- D. Construction of the 3:1 slope right of the road from approximately STA. 16+00 to 18+00.

1.15.2 CONTRACTOR Responsibilities

Once the Military construction units are finished with above-described components, the CONTRACTOR shall mobilize onto the project site on September 2, 2014 and proceed with balance the work.

PART 2 – PRODUCTS NOT USED

PART 3 – EXECUTION NOT USED

END OF SECTION 00910



**MORRISON
MAIERLE, INC.**
An Employee-Owned Company

Engineers
Surveyors
Scientists
Planners

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GLENDIVE

MAKOSHIKA STATE PARK

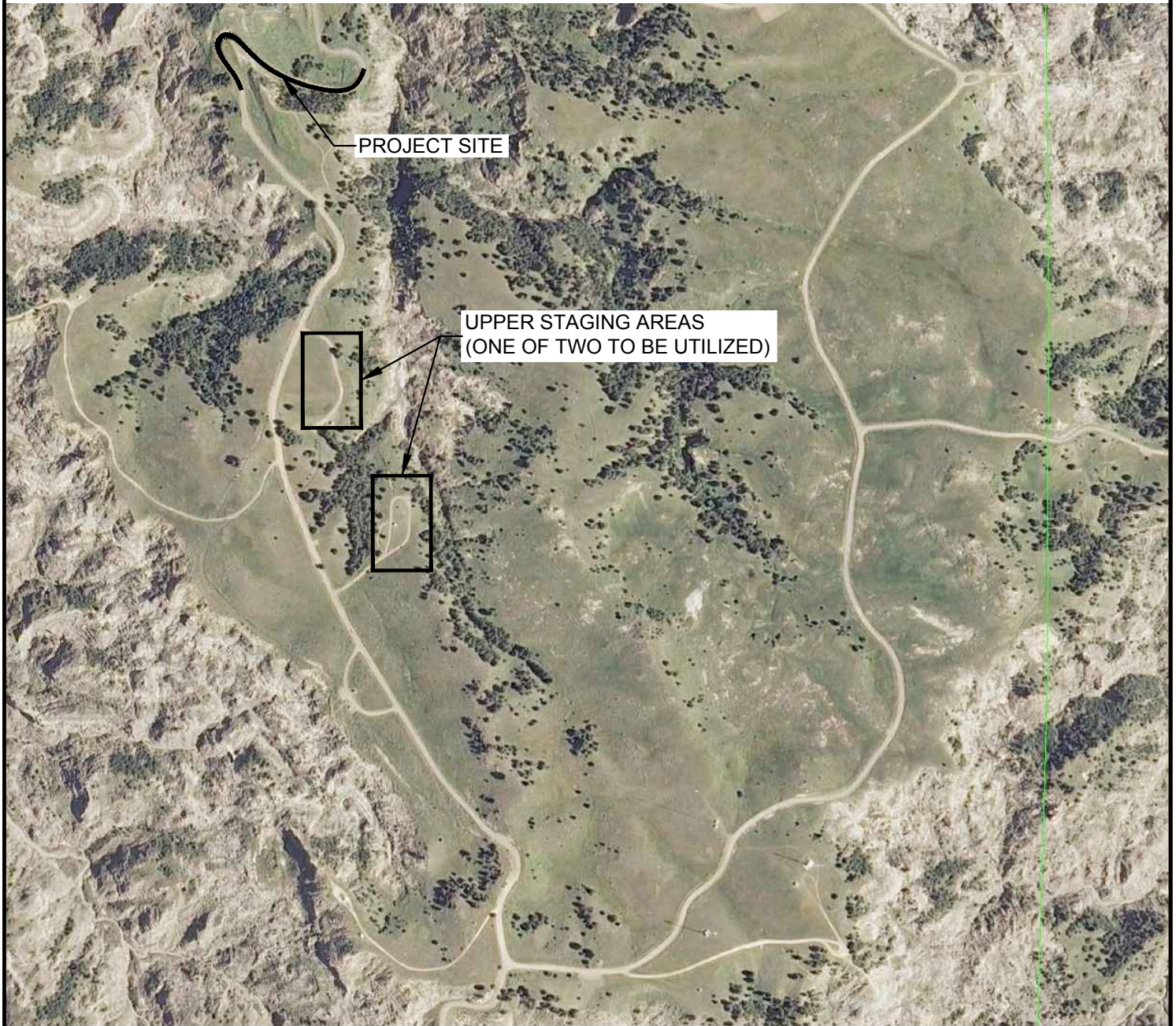
MONTANA

SWITCHBACK AND ROAD SAFETY REPAIR

PROJECT NO.
0210.034

FIGURE NUMBER

FIG. 1



**MORRISON
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GLENDIVE

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SWITCHBACK AND ROAD SAFETY REPAIR

FIGURE NUMBER

FIG. 2

PART 1 - GENERAL

1.01 SCOPE

This section of these specifications supersedes the method of measurement and basis of payment described in the various sections of the Montana Public Works Standard Specifications, Sixth Edition, April 2010. The method of measurement and basis of payment for this project is described in article 1.04 of this section.

1.02 GENERAL

The total bid price for each item of the contract shall cover all work shown on the contract drawings and required by the specifications and other Contract Documents. All costs in connection with the Work, including furnishing all materials, equipment, supplies and appurtenances; providing all construction plant, equipment, and tools; and performing all necessary labor and supervision to fully complete the Work, shall be included in the unit and lump sum prices bid. No item that is required by the Contract Documents for the proper and successful completion of the Work will be paid for outside of or in addition to the prices submitted in the bid. All work not specifically set forth as a pay item in the Bid Form shall be considered a subsidiary obligation of the CONTRACTOR and all costs in connection therewith shall be included in the prices bid.

CONTRACTOR should expect in-situ material to be in excess of optimum moisture content in some areas. All costs associated with drying, mixing excavated material with dry material, or removal of excavated material and replacement with dry material to achieve specified compaction shall be incidental for the completion of related item.

1.03 ESTIMATED QUANTITIES

All estimated quantities stipulated in the Bid Form or other Contract Documents are approximate and are to be used only as a basis for estimating the probable cost of the Work and for the purpose of comparing the bids submitted for the Work. The actual amounts of work done and materials furnished under unit price items may differ from the estimated quantities. The basis of payment for work and materials will be the actual amount of work done and materials furnished. The CONTRACTOR agrees that he will make no claim for damages, anticipated profits, or otherwise on account of any difference between the amount of work actually performed and materials actually furnished and the estimated amounts herein except as follows.

Either the OWNER or the CONTRACTOR may demand in writing that a supplemental agreement or change order be prepared to authorize an adjustment in the unit price of any MAJOR CONTRACT item if the quantity of said MAJOR CONTRACT item increases or decreases by more than 25 percent from that shown in the Contract Documents. A major contract item is defined as any bid item within the bid schedule having an original contract

value in excess of ten (10) percent of the total original contract price for the entire bid schedule.

1.04 MEASUREMENT AND PAYMENT ITEMS

Mobilization/Demobilization – Item #01: To be measured and paid by Lump Sum as follows: Twenty-five percent (25%) of the amount bid for mobilization shall be paid when five percent (5%) of the contract amount is paid for contract items and for invoiced materials in storage in that zone, an additional 50% of the amount bid for mobilization will be paid when 25% of the work is complete, and the remaining 25% will be paid when 100% of the work is completed.

Mobilization shall consist of preparatory work and operations performed by the CONTRACTOR, including, but not limited to, those necessary for the movement of their personnel, equipment, supplies, and incidentals to the project site; for the establishment of all offices, buildings, and other facilities necessary for all work in the project; and for other work and operations that must be performed or costs incurred before beginning work on the various items on the project site. Mobilization costs for subcontracted work shall be considered to be included.

Taxes, Bonds, and Insurance – Item #02: To be measured and paid by Lump Sum as follows: To be paid on the 1st progress estimate one-hundred percent (100%) upon mobilization to begin construction, only if the bid price for this item is less than five percent (5%) of the total price. For that portion of the taxes, bonds and insurance greater than five percent (5%), if any, payment shall be made for the balance of the item when 50% of the work has been completed.

General Requirements – Item #03: To be measured and paid by Lump Sum as follows: Payment shall be made as follows: Once 25% of the contract work is complete 25% of the item will be paid; at 50% of the contract, 50% more of the item will be paid; and at 100% of the contract work, the remaining 25% of the item will be paid.

General Requirements shall consist of: coordination; scheduling; submittals and quality control; construction facilities and temporary controls; storm water pollution prevention; erosion control and restoration; safety at the site; environmental quality control; permits; additional geotechnical studies; product shipment; handling; storage and protection; manufacturer's services; operation and maintenance manuals; completed record drawings; final cleanup and contract closeout.

Unclassified Excavation – Item #04: This item is measured and paid for at the number of cubic yards, as specified in the contract documents and computed using the plan lines and grades and is full compensation for all labor, equipment, tools and incidentals necessary to accomplish all clearing, grubbing, hauling and disposal as specified in the Contract documents.

Hot Mix Bituminous Asphalt – Item #05: This item is measured and paid for by the tonnage of hot mix bituminous asphalt specified in the Contract documents, complete in place. Price and payment is full shall constitute full compensation for furnishing, hauling, placing and compacting the hot mix bituminous asphalt, and for all tools, labor and incidentals necessary to complete this item.

Crushed Base Course – Item #06: This item is measured and paid for by the cubic yards of Owner supplied crushed base course of the gradations specified in the Contract documents, complete in place. Price and payment is full compensation for loading, hauling, spreading, shaping, watering and compacting the base course material, and for all tools, labor and incidentals necessary to complete this item.

24" HDPE Storm Main – Item #07: This item shall be measured by the linear feet of 24" HDPE pipe installed via horizontal directional drilling in the field. Measurement for length shall be made along the centerline of pipe from inside edge of manholes, inlets, or to connection points. Payment for this item will be made at the contract unit price bid per linear foot of 24" HDPE storm main and shall constitute full compensation for all surface improvement removals, whether shown on the plans or encountered in the field; for furnishing and installing the storm pipe; protecting or supporting existing utilities; for all cleaning of all storm pipe installed; and for all labor, equipment, tools, couplers, and incidentals necessary to complete these items.

CONTRACTOR should expect in-situ material to be in excess of optimum moisture content in some areas. All costs associated with drying, mixing excavated material with dry material, or removal of excavated material and replacement with dry material to achieve specified compaction shall be incidental for the completion of this item.

12" HDPE Storm Main – Item #08: This item shall be measured by the linear feet of 12" HDPE pipe installed in the field. Measurement for length shall be made along the centerline of pipe from inside edge of manholes, inlets, or to connection points. Payment for this item will be made at the contract unit price bid per linear foot of 12" HDPE storm main and shall constitute full compensation all surface improvement removals, whether shown on the plans or encountered in the field, including saw cutting and hauling off site; trench excavation; removal and replacement of unsuitable backfill materials; shoring; sheeting; dewatering; backfill and compaction; for furnishing and installing the storm pipe; protecting or supporting existing utilities; furnishing and placing Type I pipe bedding; for all cleaning of all storm pipe installed; and for all labor, equipment, tools, couplers, and incidentals necessary to complete these items.

CONTRACTOR should expect in-situ material to be in excess of optimum moisture content in some areas. All costs associated with drying, mixing excavated material with dry material, or removal of excavated material and replacement with dry material to achieve specified compaction shall be incidental for the completion of this item.

Outfall Erosion Control Pad – Item #09: Measurement for this item will not be made with payment made on a lump sum basis. Payment for this item will be made at the contract lump sum price for construction of the erosion control pads to the dimensions shown on the plans and shall include all excavation, grading and compaction of the areas; furnishing and installing erosion control fabric; installing Owner supplied Class II riprap; and all tools, equipment, labor, performance, and incidentals necessary to satisfactorily complete this item.

72" Storm Sewer Manhole – Item #10: This item shall be measured by the numerical count of storm sewer manholes installed to the depths indicated. Manholes shall be of the types and configurations indicated.

CONTRACTOR should expect in-situ material to be in excess of optimum moisture content in some areas. All costs associated with drying, mixing excavated material with dry material, or removal of excavated material and replacement with dry material to achieve specified compaction shall be incidental for the completion of this item.

Payment for furnishing and installing a basic manhole complete will be made at the contract unit price bid for each manhole. Such payment shall include base manhole sections steps; cast iron ring and cover; joints as specified, all excavation, removal and replacement of unsuitable backfill materials, shoring, sheeting, dewatering, backfill and compaction; and all labor, equipment, tools and incidentals required to complete the item.

Type 3 Storm Sewer Inlet w/ Median Inlet Cover – Item #11: This item shall be measured by the numerical count of Type 3 storm sewer inlets with median inlet covers installed to the depths indicated. Inlets shall be of the types and configurations indicated.

CONTRACTOR should expect in-situ material to be in excess of optimum moisture content in some areas. All costs associated with drying, mixing excavated material with dry material, or removal of excavated material and replacement with dry material to achieve specified compaction shall be incidental for the completion of this item.

Payment for furnishing and installing a basic manhole complete will be made at the contract unit price bid for each manhole. Such payment shall include base manhole sections steps; cast iron ring and cover; joints as specified, all excavation, removal and replacement of unsuitable backfill materials, shoring, sheeting, dewatering, backfill and compaction; and all labor, equipment, tools and incidentals required to complete the item.

Roadside Swale – Item #12: This item is measured and paid for at the number of lineal feet of roadside swale constructed in the field as specified by the Contract documents. Payment for this item will be made at the contract unit price bid per lineal foot and shall constitute full compensation for all furnishing and installing bento-mat liner; installing Owner supplied Class I/II riprap; all excavation and compaction, and all labor, materials, equipment, tools, and incidentals required to construct the swale.

Bento-Mat Liner and Slope Regrading – Item #13: Measurement for this item will not be made with payment made on a lump sum basis. Payment for this item will be made at the contract lump sum price for regrading of the anchor block area to the lines and grades shown on the plans and shall include all grading and compaction of the areas; furnishing and installing Bento-mat liner, topsoil and erosion control mat; seeding; and all tools, equipment, labor, performance, and incidentals necessary to satisfactorily complete this item.

Slope Regrading – Item #14: Measurement for this item will not be made with payment made on a lump sum basis. Payment for this item will be made at the contract lump sum price for regrading of the drain areas to the lines and grades shown on the plans and shall include all grading and compaction of the areas; furnishing and installing topsoil and erosion control mat; seeding; and all tools, equipment, labor, performance, and incidentals necessary to satisfactorily complete this item.

Post-tensioned Anchors – Item #15: This item is measured per each for each post-tensioned anchor installed and accepted. Post-tensioned ground anchor performance tests and construction of temporary access roads and/or pads will be considered incidental to this item. Payment for this item will be made at the contract unit price bid per each of the post-tensioned anchors and shall include furnishing, installing, and proof testing each post-tensioned ground anchor and shall constitute all labor, materials, equipment, tools and accessories for performing all work required to install the anchors.

Horizontal Drains – Item – Item #16: This item shall be measured per lineal foot for each drain installed and accepted. The collector system including headworks and other appurtenances shall be considered incidental to this item. Payment for the 12" HDPE pipe will be paid for separately under bid item #8. Payment for this item will be made at the contract unit price bid per lineal foot and shall constitute full compensation for all labor, materials, equipment, tools, and accessories for performing all work required to install the horizontal drains and collector system.

Steel W-Beam Guardrail – Item #17: This item is measured and paid for at the number of lineal feet, from center-to-center of the end posts of each section of guardrail installed in the field excluding end treatment sections. Payment for this item will be made at the contract unit price bid per lineal foot and shall constitute full compensation for all labor, materials, equipment, tools, and accessories for performing all work required to install guardrail.

ET 2000 End Treatments – Item #18: This item is measured and paid for at the number of end treatments installed. Payment for this item will be made at the contract unit price bid per each end treatment and shall constitute full compensation for all labor, materials, equipment, tools, and accessories for performing all work required to install the end treatments.

Striping and Signage – Item #19: Measurement for this item will not be made with payment made on a lump sum basis. The CONTRACTOR shall paint all center line striping, lane markings, and install all signs as specified in the Contract documents. Repainting of any pavement markings dulled, covered, scratched, marred or otherwise disturbed outside the work are will be made incidental to this item. Payment at the contract lump sum price shall constitute full compensation for surface cleaning, preparation for the particular markings, application of paint, furnishing signage, and all tools, equipment, labor, performance, and incidentals necessary to satisfactorily complete this item.

36" Edge Drain – Item #20: This item shall be measured per lineal foot of 36" Edge Drain installed in the field. Measurement for length shall be made along the centerline of the drain from the beginning point to the inside edge of the manhole connection. Payment for this item will be made at the contract unit price bid per linear foot of the Edge Drain and shall constitute full compensation for furnishing and installing the Edge Drain; trenching; protecting or supporting existing utilities; and for all labor, materials, equipment, tools, and accessories for performing all work required to install the horizontal drains and collector system.

24" HDPE Culvert – Item #21: This item shall be measured by the linear feet of 24" HDPE pipe installed in the field. Measurement for length shall be made along the centerline of pipe from inside edge of FETS. Payment for this item will be made at the contract unit price bid per linear foot of the size and type called for and shall constitute full compensation for all surface improvement removals, whether shown on the plans or encountered in the field, including saw cutting and hauling off site; trench excavation; removal and replacement of unsuitable backfill materials; shoring; sheeting; dewatering; backfill and compaction; for furnishing and installing the storm pipe and flared end treatment sections; protecting or supporting existing utilities; furnishing and placing Type I pipe bedding; for all cleaning of all storm pipe installed; and for all labor, equipment, tools, couplers, and incidentals necessary to complete these items.

CONTRACTOR should expect in-situ material to be in excess of optimum moisture content in some areas. All costs associated with drying, mixing excavated material with dry material, or removal of excavated material and replacement with dry material to achieve specified compaction shall be incidental for the completion of this item.

END OF SECTION 01025